



State of Utah

GARY R. HERBERT
Governor

GREG BELL
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

MEMORANDUM

TO: Utah Water Quality Board

THROUGH: Walter L. Baker, P.E.

FROM: Jeff Ostermiller

DATE: April 12, 2012

SUBJECT: Request for release of set aside funds for the Willard Spur investigation

Recommended Water Quality Board Action

DWQ recommends that the Water Quality Board release \$820,000 of the \$1,405,000 that the Board previously authorized for conducting the investigations. With this action \$261,000 would remain available for commitment.

Background

The objective for work in 2011 was to establish a baseline condition of Willard Spur that would inform the development of a research program to address stated program objectives. As such, DWQ worked with members of the Steering Committee to develop and implement a comprehensive sampling plan, form an expert Science Panel, and then work with the Science Panel to identify research needs, priorities, and finally develop a Research Plan for the program.

The Research Plan aims to answer the overall objective:

What water quality standards are fully protective of beneficial uses of Willard Spur waters as they relate to the proposed POTW (publicly owned treatment works) discharge?

Two questions were identified that follow from the program objective, i.e., these questions must be answered for the program objective to be achieved. The questions are as follows:

1. *What are the potential impacts of the Perry Willard Regional Wastewater Treatment Plant (WWTP) on Willard Spur?*
2. *What changes to water quality standards will be required to provide long-term protection of Willard Spur?*

Research projects, with their own questions to be answered, were defined for three research areas:

1. *Understanding the food web*
2. *Hydrology/Nutrient Budget*
3. *Understanding nutrient cycling/response*

The Science Panel worked to prioritize the research and recommended an approach to fill key data gaps to the Steering Committee, which approved it in October 2011. The approach focuses efforts to first understand the available literature and how Willard Spur has changed up until the present time. Research Areas Nos. 1 and 2 will identify significant factors in shaping Willard Spur's present condition, how nutrients may impact the ecosystem, how the WWTP is currently impacting Willard Spur, and recommend further research to fill key data gaps in areas specifically related to the two research questions above. Research Area No. 3 focuses on the future by observing how Willard Spur responds to elevated nutrient levels, identifying how the WWTP may impact Willard Spur over the long term, and how DWQ can monitor conditions to prevent adverse impacts.

Results from 2011

Intensive surveys of chemical data and biological responses were conducted throughout 2011. The Science Panel and DWQ are just scratching the surface with regard to data analysis. While it is difficult to draw sweeping conditions based on a single collection season, especially one with unusual hydrologic conditions, several interesting observations have been made:

- 2011 was the first time in a couple of decades when the Spur retained hydrological connection to Bear River Bay throughout the growing season.
- The bay currently has very low nutrients, both within the water column and in sediment.
- In terms of annual loads, the WWTP contributed few nutrients relative to other sources. However, it is not clear whether this would be the case during summer low pool conditions.
- In 2011, biological activity was extremely high throughout the growing season, which should correlate with a high assimilative capacity of nutrients within the Spur.
- The growing season consisted of two very distinct conditions: a clear water phase with lush macrophyte growth, followed by a period where production was dominated by phytoplankton. Each of these conditions has different implications for the cycling and storage of nutrients.

Proposed Work for 2012

Further detail on the proposed work may be found at the project website:

<http://www.willardspur.utah.gov/index.htm>. Literature reviews and some limited evaluation of mapping and data are proposed for Research Area No. 1. This work will be completed by local researchers with the intent of asking them what they recommend as critical work. Flow monitoring, environmental sampling, and several special studies have been identified as part of Research Area No. 2 to evaluate the condition of Willard Spur during expected dry conditions in 2012 (vs. the wet conditions in 2011), determine if there is an impact from the WWTP during these critical conditions, and augment the work completed in Research Area No. 3. The nutrient

cycling study being completed as part of Research Area No. 3 will provide detailed observations of ambient conditions and four test plots where the water column is treated to provide elevated nutrients (two concentrations) and where the sediment is treated with elevated nutrients (two concentrations). This work will identify when and what triggers occur prior to and during significant responses of the system to elevated nutrients. This will allow DWQ to evaluate the impact of the WWTP over the long term as well as identify a strategy for monitoring conditions with the goal of preventing adverse impacts.

Steering Committee Recommendations

The proposed research for 2012 presents an integrated approach to addressing the key objectives of the program. Each study informs and supports the others. They address historical impacts, present impacts, and potential future impacts. They will significantly advance the current understanding of nutrient cycling by GSL wetlands how they respond to nutrients. They will facilitate the identification of various management alternatives for consideration and final recommendations from the Steering Committee to DWQ. The question of whether the project should proceed was raised at the April 5, 2012 Steering Committee meeting. After a review of the proposed work for 2012 and discussion over how they address the program objectives, there was unanimous support to continue the research program as proposed for 2012. Below are a few of the key points of discussion:

1. DWQ entered into informal and formal agreements with U.S. Fish and Wildlife Service, and other stakeholders, to complete a research program to evaluate if and how Willard Spur can be better protected. The Steering Committee and Science Panel were charged to address this objective. Ending or curtailing efforts at this time would violate those agreements.
2. Some concern was expressed about funds being expended for an area that does not receive much use by humans, especially give the WWTP's relatively low flow of 1 MGD. In 2011 the project team found that Willard Spur was a unique and valuable resource that appeared by almost all measures to have high chemical, physical and biological integrity. Conditions in 2011 were, however, unique. Estimated snowpack levels in April 2011 were at 185% of normal. Estimated snowpack levels today are at 65% of normal. Thus, conditions in 2011 presented conditions with high flushing and diluting flows and intensive biological growth. These were almost ideal conditions for the ecosystem. The expected dry to normal conditions in 2012 present DWQ with the opportunity to evaluate the impacts of the Plant during more critical conditions. These are the conditions that the Science Panel previously identified as most likely to represent critical conditions.
3. A question was raised about whether we now know enough to definitively conclude that the effluent from the WWTP does not negatively impact the Spur. Several members responded with caution against making too strong of generalizations based on a single year of data collection. Several members pointed out that wetlands throughout the GSL ecosystem were very different in 2011, physically and biologically, than those in previous years
4. Research being completed in Willard Spur does provide DWQ and other agencies with the opportunity to significantly advance our understanding of the GSL ecosystem and how to better protect its resources. DWQ has formed a cohesive group of stakeholders and experts focused upon this issue. The science that is advanced and discussions that take place will serve as invaluable resources as DWQ and other agencies weigh

alternatives for protecting GSL. Indeed, several people expressed gratitude for the manner in which the study was being conducted and stated that they were impressed by the efficient use of resources.

TABLE 1

Overall Budget

Development of Water Quality Standards for Willard Spur

Summary of 2011 Expenses

2011 Monitoring and Project Management (see Table X)	\$333,658
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Summary of 2012 Budget

2012 Monitoring (see Table 2)	
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DWQ Personnel	\$60,000
Misc. Equipment	\$20,000
Laboratory analysis	\$92,577

TOTAL FOR 2012 MONITORING	\$172,577
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2012 Special Studies (see Table 3)	
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Site-Wide Intensive Sampling Study	\$15,300
Sonde Deployment	\$ -
Nutrient Uptake Capacity of Willard Bay Tailrace	\$12,000
Macroinvertebrate Stable Isotope Analysis	\$ 3,000
Macroinvertebrate Life History Analysis	\$1,700
Nutrient Assimilation of Harold Crane WMA	\$500

TOTAL FOR 2012 SPECIAL STUDIES	\$32,500
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2012 Research Studies (see Table 4)	
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Avian Use Literature Review	\$21,082
Vegetation/Habitat Mapping & Literature Review	\$24,380
Fish Use Literature Review	\$16,717
Macroinvertebrate Evaluation & Literature Review	\$2,500
Hydrology Monitoring	\$82,300
Nutrient Cycling Study	\$250,000

TOTAL FOR 2012 RESEARCH STUDIES	\$ 396,979
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2012 Project Management (see Table 5)	
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Project Management, Database, Data Management, Analysis	\$200,000
Science Panel/Steering Committee Meeting Travel/Expenses	\$15,000

TOTAL FOR 2012 PROJECT MANAGEMENT	\$ 215,000
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TOTAL COSTS FOR 2012 BUDGET	\$817,056
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TOTAL COSTS FOR 2011-2012	\$ 1,150,714
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ALLOCATED MONIES	\$ 1,415,000
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TABLE 2

Summary of 2012 Monitoring

Development of Water Quality Standards for Willard Spur

Implementation of 2012 Sampling Plan

Objective: Provide baseline condition information, allow comparison between 2011 and 2012, evaluate impact of nutrients on Willard Spur.

Methods: Sampling and monitoring of inflow and open water sites in Willard Spur per 2012 Sampling Plan.

Description	Quantity	Units	Unit Cost	SubTotal	In Kind
DWQ personnel	2	EA	\$30,000	\$60,000	
Equipment	1	LS	\$ 25,000	\$25,000	
Macroinvertebrate sample analysis	185	EA	\$175	\$32,375	
Diatom sample preservation	37	EA	\$25	\$925	
Phytoplankton sample analysis	325	EA	\$150	\$48,750	
Sediment sample analysis	121	EA	\$87	\$10,527	
Water sample analysis (TP and TN for inflow sites)	318	EA	\$40		\$12,720
Water sample analysis (nutrient cycling suite)	252	EA	\$198		\$49,896

ESTIMATED COST OF 2012 MONITORING:

\$ 177,577

TABLE 3

Summary of 2012 Special Studies Augmenting DWQ Sampling Plan

Development of Water Quality Standards for Willard Spur

Site-Wide Intensive Sampling Event

Objective: One time sampling event to evaluate spatial differences in the open water and evaluate nutrient assimilation along an existing fringe wetland input.

Methods: Sample water, sediment, macroinvertebrates, zooplankton, and phytoplankton and monitor vegetation at 25 locations.

Cost: (using DWQ labor and equipment) \$15,300

Sonde Deployment

Objective: Monitor DO, temp, pH over 7 day periods to characterize diurnal variations and coincidence with nutrient responses.

Methods: Will use available DWQ equipment

Cost: (using DWQ labor and equipment, no lab cost) \$-

Nutrient Uptake Capacity of Willard Bay Tailrace

Objective: Characterize the biological nutrient uptake capacity of the Willard Bay Tailrace to estimate nutrient load actually reaching Willard Spur.

Methods: Established protocol developed by Utah State University for stream systems (Tank et al., 2008 and Covino et al., 2010).

Cost: (DWQ labor and equipment, contract with Dr. Michelle Baker) \$12,000

Macroinvertebrate Stable Isotope Analysis

Objective: Understand the lower food web and trophic interaction in the ecosystem (i.e., what are the food sources and sources of nutrients in that food?).

Methods: Stable isotope analysis of macroinvertebrates, zooplankton, plants, algae, and detritus.

Cost: (DWQ labor and equipment, contract with Dr. Larry Gray) \$3,000

Macroinvertebrate Life History Analysis

Objective: Understand how normal life cycle changes in abundance relate with changes in populations and changes in physical/chemical factors.

Methods: Augment routine sampling with three additional sampling events at three sites. Will describe changes every 2 weeks from July - September.

Cost: (DWQ labor and equipment, contract with Dr. Larry Gray) \$1,700

Nutrient Assimilation in Harold Crane WMA

Objective: Confirm pattern observed in 2011 of nutrient assimilation in Harold Crane WMA impoundments.

Methods: Augment routine sampling at the WMA with two sampling events, 5 water samples each.

Cost: (using DWQ labor and equipment) \$500

ESTIMATED COST OF 2012 SPECIAL STUDIES:

\$32,500

TABLE 4

Summary of 2012 Research Studies

Development of Water Quality Standards for Willard Spur

Research Area No. 1 - Understanding the Food Web

Avian Use Literature Review

Objective: Complete a literature review to evaluate available data and models for avian species/numbers, bird foraging and reproductive use, and diet composition for birds using Willard Spur and how nutrients may impact this use. Focus on how use has changed from past until today.

Methods: Review of available literature and evaluation of available data.

Cost: (contract with Dr. John Cavitt, Weber State University) \$21,082

Vegetation/Habitat Mapping & Literature Review

Objective: Complete a literature review to evaluate available data and mapping for habitat/vegetation of Willard Spur and how nutrients may impact this use. Focus on how habitat/vegetation has changed from past until today.

Methods: Review of available literature and evaluation of available data.

Cost: (contract with Dr. Karin Kettenring, Utah State University) \$24,380

Fish Use Literature Review

Objective: Complete a literature review to evaluate available data and models for fish species/numbers, factors that may influence fish abundance, and how nutrients may impact this use. Focus on how use has changed from past until today.

Methods: Review of available literature and evaluation of available data.

Cost: (contract with Dr. Wayne Wurtsbaugh, Utah State University) \$16,717

Macroinvertebrate Evaluation & Literature Review

Objective: Complete a literature review to evaluate available data and models for macroinvertebrate species/numbers, factors that may influence macroinvertebrate abundance, and how nutrients may impact this use. Focus on how use has changed from past until today. Will compare 2011 data to other GSL data.

Methods: Review of available literature and evaluation of available data.

Cost: (contract with Dr. Larry Gray, Utah Valley University) \$2,500

TOTAL FOR RESEARCH AREA NO. 1 \$64,679

Research Area No. 2 - Hydrology/Nutrient Budget

Hydrology Monitoring

Objective: Understand the sources and timing of how water and nutrients are conveyed into Willard Spur.

Methods: Deploy DWQ, USGS, USBR, and PRWWTP resources to measure flow at 31 inflow locations, monitor water levels at 4 locations, and monitor meteorological conditions at one location.

Cost: (DWQ labor and equipment, USGS contract, publicly available data, agreements with DWR and \$82,300

TOTAL FOR RESEARCH AREA NO. 2	\$82,300
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TABLE 4 (continued)

Research Area No. 3 - Nutrient Cycling/Responses

Nutrient Cycling Study

Objective: Observe how Willard Spur open water wetlands respond to various nutrient levels from water and sediment sources. Identify triggers that can be used for monitoring conditions.

Methods: 2012 literature review, field experiments to observe responses to nutrient treatment sites, and recommendations to refine research to define thresholds/mechanisms useful for defining impacts and monitoring condition. 2013 to focus upon final experiments and recommendations.

Cost: (contract with Dr. Bill Johnson, University of Utah)	\$250,000
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TOTAL FOR RESEARCH AREA NO. 3	\$250,000
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TOTAL COSTS for 2012 RESEARCH CONTRACTS	\$396,979
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TABLE 5

Summary of 2012 Project Management

Development of Water Quality Standards for Willard Spur

Project Management

Objective: Manage and coordinate the various studies, monitoring, and research activities and communication with DWQ, investigators, Steering Committee and Science Panel. Supplement DWQ staff as needed for data management and analysis.

Methods:

Adjudication of 2011 Data	\$	10,000
Development of 2011 Database	\$	13,000
2011 Hydrologic & Nutrient Load Summaries	\$	12,000
Development of 2012 Research Studies, Special Studies, Sampling Plan	\$	10,000
Steering Committee and Science Panel		
ination/Facilitation	\$	30,000
Management/coordination of contracted work	\$	70,000
Data Management/Analysis	\$	55,000
Cost: (CH2M HILL contract)	\$	200,000

Steering Committee/Science Panel Meetings

Objective: Pay for misc. travel expenses for Science Panel members to participate in project meetings and expenses for meetings (equipment, rentals, food)

Cost: (through DWQ)	\$	15,000
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ESTIMATED COST OF 2012 MONITORING: **\$ 215,000**

TABLE 6**Summary of 2011 Expenses**

2011 Monitoring and Project Management (see Table X)	\$333,658
AATV	\$20,000
Airboat	\$30,000
Interns	\$32,500
TOTAL FOR 2011 MONITORING	\$ 82,500
Research & Project Management	
USGS Flow Monitoring	\$78,300
WSU Waterfowl Diet Study	\$12,858
Wasatch Civil - surveying at HCWMA	\$ 4,500
CH2M HILL Proj Mgnt, Database, & Analysis	\$155,500
TOTAL FOR 2011 RESEARCH & PROJECT MANAGEMENT	\$ 251,158
TOTAL COSTS FOR 2011	\$333,658